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Licensing Requirements

For a complete explanation of Cisco NX-OS licensing recommendations and how to obtain and apply licenses, see the [Cisco NX-OS Licensing Guide](#) and the [Cisco NX-OS Licensing Options Guide](#).

Supported Platforms

Starting with Cisco NX-OS release 7.0(3)I7(1), use the [Nexus Switch Platform Support Matrix](#) to know from which Cisco NX-OS releases various Cisco Nexus 9000 and 3000 switches support a selected feature.

About Interfaces

Cisco NX-OS supports multiple configuration parameters for each of the interface types supported. Most of these parameters are covered in this guide but some are described in other documents.

The following table shows where to get further information on the parameters you can configure for an interface.

Table 1: Interface Parameters

Feature	Parameters	Further Information
Basic parameters	Description, duplex, error disable, flow control, MTU, beacon	“Configuring Basic Interface Parameters”
Layer 3	Medium, IPv4 and IPv6 addresses	“Configuring Layer 3 Interfaces”

Feature	Parameters	Further Information
Layer 3	Bandwidth, delay, IP routing, VRFs	<i>Cisco Nexus 9000 Series NX-OS Unicast Routing Configuration Guide</i> <i>Cisco Nexus 9000 Series NX-OS Multicast Routing Configuration Guide</i>
Port Channels	Channel group, LACP	“Configuring Port Channels”
Security	EOU	<i>Cisco Nexus 9000 Series NX-OS Security Configuration Guide</i>

Ethernet Interfaces

- Ethernet interfaces include routed ports.
- For N9K-C9316D-GX, Ports 1-16 supports 400G/100G/40G, and 10G with QSA.

Cisco Nexus N9K-C9364C-GX and N9K-C93600CD-GX switches have the following guidelines and limitations:

- Consecutive groups of four interfaces (1-4, 5-8, 9-12, and so on, are referred to as a quad group). Attempting to use a mix of link speeds within a quad group is not supported. This applies to ports 1-24 of the N9K-C93600CD-GX and all ports of the N9K-C9364C-GX.
- Only one speed will be up in a quad group at a time. The first link up in a quad group determines the speed of the quad group. Ports with any other speed will be down with the reason of "Link not connected".
- The speed which remains functional when mixing within a quad group is not stored. When a mismatched speed transceiver is inserted into a quad group and brought up, all ports in the quad group will be reset. The first link which comes up after the reset determines the speed of the quad group. It is possible that pre-existing links may be shut down. You can remove the mismatched speed transceiver to recover from this state.
- FC-FEC is not supported on the second lane of the 50Gx2 breakout port. The second breakout port will not come up when 50Gx2 breakout is configured, ensure to configure RS-FEC with 50Gx2 breakout.

Access Ports

An access port carries traffic for one VLAN. This type of port is a Layer 2 interface only.

For more information on access ports, see the “Information About Access and Trunk Interfaces” section.

Routed Ports

A routed port is a physical port that can route IP traffic to another device. A routed port is a Layer 3 interface only.

For more information on routed ports, see the “Routed Interfaces” section.

Management Interface

You can use the management Ethernet interface to connect the device to a network for remote management using a Telnet client, the Simple Network Management Protocol (SNMP), or other management agents. The management port (mgmt0) is autosensing and operates in full-duplex mode at a speed of 10/100/1000 Mb/s.

For more information on the management interface, see the [Cisco Nexus 9000 Series NX-OS Fundamentals Configuration Guide](#).

Port-Channel Interfaces

A port channel is a logical interface that is an aggregation of multiple physical interfaces. You can bundle up to 32 individual links (physical ports) into a port channel to improve bandwidth and redundancy. For more information about port-channel interfaces, see the “Configuring Port Channels” section.

Subinterfaces

You can create virtual subinterfaces using a parent interface configured as a Layer 3 interface. A parent interface can be either a physical port or a port-channel. A parent interface can be a physical port. Subinterfaces divide the parent interface into two or more virtual interfaces on which you can assign unique Layer 3 parameters such as IP addresses and dynamic routing protocols.

Loopback Interfaces

A loopback interface is a virtual interface with a single endpoint that is always up. Any packet that is transmitted over a virtual loopback interface is immediately received by that interface. Loopback interfaces emulate a physical interface. For more information about subinterfaces, see the “Loopback Interfaces” section.

Breakout Interfaces

Cisco NX-OS supports the breakout of a high bandwidth interface into one or more low bandwidth interfaces at the module level or at the per-port level.

Module Level Breakout

For module level breakout, the **interface breakout** command splits the high bandwidth 40G interface of a module into four 10G interfaces. The module is reloaded and the configuration for the interface is removed when the command is executed.

The following is an example of the command:

```
switch# configure terminal
switch(config)# interface breakout module 1
Module will be reloaded. Are you sure you want to continue(yes/no)? yes
```

The **no interface breakout module *module_number*** command undoes the breakout configuration. It puts all interfaces of the module in 40G mode and deletes the configuration for the previous 10G interfaces.

Dynamic Breakout (Per-port Level Breakout)

For dynamic breakout (per-port level breakout), the **interface breakout** command splits high bandwidth 40G ports into four 10G breakout ports and 100G ports into four 25G breakout ports. The breakout ports are identified as **Ethernet** *<slot>/<front-panel-port>/<breakout-port>*. For example, per-port level breakout ports can be identified as **Ethernet 1/2/1**, **Ethernet 1/2/2**, **Ethernet 1/2/3**, and **Ethernet 1/2/4**.

When one or more 40G interfaces of the module are broken-out at the per-port level, the configuration for the interfaces are removed when the command is executed.



Note A per-port level breakout does not require the module to be reloaded.

The following is an example of configuring a breakout port:

```
switch(config)# interface breakout module 1 port 1 map 10g-4x
switch(config)#
```

The following is an example of configuring a multiple breakout ports:

```
switch(config)# interface breakout module 1 port 1-4 map 10g-4x
switch(config)#
```

The following is an example of configuring 40G and 10G interfaces mixed together.

```
switch(config-if)# show int eth1/49 transceiver
Ethernet1/49
transceiver is present
type is QSFP-40G-SR-BD
name is CISCO-AVAGO
part number is AFBR-79EBPZ-CS2
revision is 01

switch(config-if)# show int eth1/52 transceiver
Ethernet1/52
transceiver is present
type is QSFP-Cazadero
name is CISCO-DNI
part number is CAZADERO-R
revision is 03
nominal bitrate is 10000 MBit/sec per channel

switch(config-if)# show int eth1/53 transceiver
Ethernet1/53
transceiver is present
type is QSFP-Cazadero
name is CISCO-DNI
part number is CAZADERO-R
revision is 03
nominal bitrate is 10000 MBit/sec per channel

switch(config)# interface breakout module 1 port 52-53 map 10g-4x

switch(config-if)# show int br | i up
mgmt0 -- up 10.122.160.192 100 1500
Eth1/49 -- eth routed up none 40G(D) -- << Running 40G
Eth1/50 -- eth routed up none 40G(D) --
Eth1/52/1 -- eth routed up none 10G(D) -- << Broken out to 10G
Eth1/53/1 -- eth routed up none 10G(D) -- << Broken out to 10G
```

You can undo the breakout ports with the **no interface breakout** command.

The following is an example to undo the breakout ports:

```
switch(config)# no interface breakout module 1 port 1 map 10g-4x
switch(config)#
```

About the Lane Selector

The lane selector is a push button switch and 4 LEDs located on the Cisco Nexus switch (left side of front panel, labeled "LS"). The push button switch and LEDs are used to indicate the status of the ports. The lane selector is supported on Cisco Nexus Series 9000 series switches and the Cisco Nexus 3164 and 3232 switches.

By default, the LEDs indicate the link/activity status of a 1 x 40G configuration. When the ports are configured as 4 x 10G, you can access the link status of each individual 10G port with the lane selector.

By pressing the lane selector push button, the port LED shows the selected lane's link/activity status. The 1st time the push button is pressed, the first LED displays the status of the first port. Pressing the push button a 2nd time displays the status of the second port, and so on. You can display the status of each of the four ports by pressing the push button in this manner.

For example, if port 60 is configured as 4 x 10G, pressing the lane selector push button once displays the link status of 60/1/1. Pressing the push button a second time displays the link status of 60/1/2.

When you press the push button after displaying the status of the last port, all four of the LEDs should extinguish to indicate that the lane selector has returned to display the status for the default 1 x 40G configuration.



Note A 10G breakout port's LED blinks when the beacon feature has been configured for it.



Note When a port is configured to be in 10G breakout mode and no lane is selected, the 40G port's LED illuminates as green even though only one of the 10G breakout ports is up.

Notes About Breakout Interfaces

Cisco Nexus 9516 switch does not support breakout on Modules 8 to 16.

Beginning with Cisco NX-OS Release 7.0(3)F2(1), the 36-port 100-Gigabit Ethernet QSFP28 line cards (N9K-X9636C-R) and 36-port 40-Gigabit Ethernet QSFP+ line cards (N9K-X9636Q-R) provide 4x10-Gigabit support.

Beginning with Cisco NX-OS Release 9.2(1), N9K-9636C-R, N9K-X9636Q-R and N9K-X9636C-RX line cards support breaking out 40G ports into 4x10 Gigabits.

Beginning with Cisco NX-OS Release 9.2(2), N9K-X9636C-R and N9K-X9636C-RX line cards support breaking out 100G ports into 4x25 Gigabits. From Cisco NX-OS Release 9.3(3), the default FEC mode on N9K-X9636C-R and N9K-X9636C-RX is FC-FEC for 25Gx4 and 50Gx2. The N9K-C9636C-R does not support RS-FEC and the N9K-X96136YC-R line card does not support breakout.

The Cisco Nexus 93600CD-GX switch is a 1-rack unit (RU) fixed-port switch offering 28 40/100-Gigabit QSFP28 ports, 8 100/400-Gigabit QSFP-DD ports, 2 management ports, 1 console port (RS-232), and 1 USB port. The Cisco Nexus 93600CD-GX switch supports breakout feature.

Beginning with Cisco NX-OS Release 9.3(3), Cisco Nexus 9500 R-Series switches support breaking out 100G ports into 2x50 Gigabits.

The following table provides detailed information of the supported or not supported breakout modes. For more information, see [Cisco Nexus Data Sheets](#):

Table 2: Breakout Modes Support Matrix

Switches	4x10G	4x25G	2x50G
N9K-X9636C-RX	Yes	Yes	Yes
N9K-X9636C-R	Yes	Yes	Yes
N9K-X9636Q-R	Yes	No	No
N9K-X96136YC-R	No	No	No
N9K-93108TC-EX	Yes	Yes	Yes
N9K-93180YC-EX	Yes	Yes	Yes
N9K-93180YC-FX	Yes	Yes	Yes
N9K-9348GC-FXP	Yes	Yes	Yes



Note On Nexus 9500 R-Series switches with N9K-X9636C-R and N9K-X9636C-RX line cards, limited optics (QSFP-100G-PSM4-S, QSFP-100G-AOC, QSFP-100G-CU1M-CU3M) are supported with 2x50G and 4x25G breakout. For more information see *Cisco Optics-to-Device Compatibility Matrix*.

Caveats

- As of Cisco NX-OS Release 7.0(3)I7(2), manual breakout of QSA ports is not supported.

Manual breakout is supported on the following platforms because auto-breakout does not happen successfully on them—N9K-C93128TX, N9K-9332, N9K-C9396PX, N9K-C9396TX, N9K-C9372PX, N9K-C9372TX, N9K-C9332PQ, N9K-C93120TX, N9K-9432PQ, N9K-9536PQ, N9K-9636PQ, N9K-X9632PC-QSFP100, N9K-X9432C-S, N3K-C3132Q-V, N3K-C3164Q, N3K-C3132C, N3K-C3232C, N3K-C3264Q, N3K-C3264C, N3K-3064Q, N3K-3016, N3K-3172.

You need to perform manual breakout using "interface breakout module <module number> port <port range> map <breakout mapping>" command.

- When a break-out port is configured as a part of a port-channel, you need to apply the configuration twice (after write-erase/reload), to ensure the effectiveness of the port-channel.
- When you upgrade a Cisco Nexus 9000 device to Cisco NX-OS Release 7.0(3)I7(2) or later releases, if a QSFP port is configured with the manual breakout command and is using a QSA, the configuration of the interface Ethernet 1/50/1 is no longer supported and will need to be removed. To restore the configuration, you must manually configure the Ethernet 1/50 on the device.

This behaviour is not applicable to the following platforms—N9K-C93128TX, N9K-9332, N9K-C9396PX, N9K-C9396TX, N9K-C9372PX, N9K-C9372TX, N9K-C9332PQ, N9K-C93120TX, N9K-9432PQ, N9K-9536PQ, N9K-9636PQ, N9K-X9632PC-QSFP100, N9K-X9432C-S, N3K-C3132Q-V, N3K-C3164Q,

N3K-C3132C, N3K-C3232C, N3K-C3264Q, N3K-C3264C, N3K-3064Q, N3K-3016, N3K-3172—because manual breakout is supported on these platforms.

- Cisco Nexus 9000 Series switches have 40G ports. When you breakout one of the 40G ports into 4x10G ports with a QSFP breakout cable, not all of the subinterfaces can be added to a port channel. The following error message is displayed:

```
switch# channel-group 99 mode active
command failed: port not compatible [Buffer boost]
```



Note As a workaround, configure **no buffer-boost** on all of the subinterfaces. This enables the channel-group configuration to go through.

Using the **force** keyword on the port-channel does not enable all the interfaces to be added to the port-channel even though the error message suggests using the keyword.

- Beginning with Cisco NX-OS Release 7.0(3)I7(3) you see two additional options to configure FEC such as **rs-cons16** and **rs-ieee** as per IEEE standards.
- Beginning with Cisco NX-OS Release 7.0(3)I7(7) you can display the admin and oper status of FEC interface information with the **show interface fec** command.

Example:

```
switch# show interface fec
-----
Name   Ifindex Admin-fec Oper-fec   Status  Speed  Type
-----
Eth1/1  0x1a000000 auto   auto  connected   10G   SFP-H10GB-AOC2M
Eth1/2  0x1a000200          Rs-fec  notconnected auto   QSFP-100G-AOC3M
Eth1/3/1 0x38014000 auto   auto  disabled auto   QSFP-H40G-AOC3M
Eth1/3/2 0x38015000 auto   auto  disabled auto   QSFP-H40G-AOC3M
Eth1/3/3 0x38016000 auto   auto  disabled auto   QSFP-H40G-AOC3M
Eth1/3/4 0x38017000 auto   auto  disabled auto   QSFP-H40G-AOC3M
```



Note Auto-FEC is not supported in Cisco NX-OS Release 7.0(3)I7(x)

Cisco Nexus C92160YC Switch

For 7.0(3)I3(1) and later, the Cisco Nexus C92160YC switch provides two different modes of operation:

- Mode 1: 48 * 10G/25G + 4 * 40G + 2 * 100G (Default configuration)
 - Hardware profile portmode 48x25G + 2x100G + 4x40G
 - Breakout is supported in 2 * 100G ports
- Mode 2: 48 * 10G/25G + 4 * 100G
 - Hardware profile portmode 48x25G + 4x100G
 - Breakout is supported on 3 * 100G ports (Ports 50,51 & 52).

Use the **show running-config | grep portmode** command to display the current operation mode.

Example:

```
switch(config-if-range)# show running-config | grep portmode
hardware profile portmode 48x25G+2x100G+4x40G
```

See the installation guide for the Cisco Nexus C92160YC switches for more information. ([Install and Upgrade Guides for Cisco Nexus 9000 Series Switches](#))

With the Cisco Nexus C92160YC switch, there are two breakout modes:

- 40G to 4x10G breakout ports
 - Enables the breakout of 40G ports into 4 X 10G ports.
 - Use the **interface breakout module 1 port x map 10g-4x** command.
- 100G to 4x25G breakout ports
 - Enables the breakout of 100G ports into 4 X 25G ports.
 - Use the **interface breakout module 1 port x map 25g-4x** command.

Cisco Nexus C9272Q Switch

For 7.0(3)I3(1) and later, the Cisco Nexus C9272Q Switch provides 72 40G ports. Ports 37 - 71 support breakout interfaces.

To configure a breakout interface, use the **interface breakout module 1 port x map 10g-4x** command.

Example:

```
switch(config)# interface breakout module 1 port 38 map 10g-4x
switch(config)# show interface ethernet 1/38 capabilities | grep -i break
Breakout capable:      yes
```

Cisco Nexus C9332PQ Switch

For 7.0(3)I3(1) and later, the Cisco Nexus C9332PQ Switch provides 24 40G ports that support breakout mode and can be connected to four 10G NIF ports on a FEX. Ports 1 - 12 and 15 - 26 ports are supported. (Ports 13 and 14 ports are reserved and cannot be used for breakout mode.)



Note All FEXs are supported.



Note Only the Cisco Nexus 9332PQ switch provides interface breakout support for FEX fabric interfaces. (7.0(3)I3(1) and later)

Cisco Nexus 9000 C93180LC-EX Switch

For 7.0(3)I7(1) and later, Cisco Nexus 9000 C93180LC-EX switch provides three different modes of operation:

- Mode 1: 28 x 40G + 4 x 40G/100G (Default configuration)
 - Hardware profile portmode 4x100g + 28x40g.
 - 10x4 breakout is supported on the top ports from 1 to 27 (ports 1,3,5, 7...27). If any of the top port is broken out, the corresponding bottom port becomes non-operational. For example, if port 1 is broken out port 2 becomes non-operational.
 - 1 Gigabit and 10 Gigabit QSA is supported on ports 29, 30, 31, and 32. However, QSAs on the top and bottom front panel ports must be of same speed.
 - Ports 29, 30, 31, and 32 support 10x4, 25x4, and 50x2 breakout.
- Mode 2: 24 x 40G + 6 x 40G/100G
 - Hardware profile portmode 6x100g + 24x40g.
 - 10x4 breakout is supported on the top ports from 1 to 23 (ports 1,3,5, 7...23). If any of the top port is broken out the corresponding bottom port becomes non-operational.
 - Ports 25, 27, 29, 30, 31, and 32 support 10x4, 25x4, and 50x2 breakout.
 - 1 Gigabit and 10 Gigabit QSA is supported on ports 29, 30, 31, and 32. However, QSAs on the top and bottom front panel ports must be of same speed.
- Mode 3: 18 x 40G/100G
 - Hardware profile portmode 18x100g.
 - 10x4, 25x4, and 50x2 breakout is supported on top ports from 1 to 27 (ports 1,3,5, 7...27) and on ports 29,30,31,32.
 - 1 Gigabit and 10 Gigabit QSA is supported on all the 18 ports.

Changing Mode 3 to any other mode or vice versa requires **copy running-config startup-config** command followed by **reload** command to take effect. However, moving between Modes 1 and 2 is dynamic and requires only **copy running-config startup-config** command.

Use the **show running-config | grep portmode** command to display the current operation mode.

Example:

```
switch(config-if-range)# show running-config | grep portmode
hardware profile portmode 4x100G+28x40G
```

With the Cisco Nexus C93180LC-EX switch, there are three breakout modes:

- 40G to 4x10G breakout ports
 - Enables the breakout of 40G ports into 4 X 10G ports.
 - Use the **interface breakout module 1 port x map 10g-4x** command.

- 100G to 4x25G breakout ports
 - Enables the breakout of 100G ports into 4 X 25G ports.
 - Use the **interface breakout module 1 port x map 25g-4x** command.
- 100G to 2x50G breakout ports
 - Enables the breakout of 100G ports into 2 X 50G ports.
 - Use the **interface breakout module 1 port x map 50g-2x** command.

Cisco Nexus 9000 C9364C-GX Switch

Cisco Nexus N9K-C9364C-GX breakout considerations:

- For ports 1-64, 2 x 50G, 4 x 25G and 4 x 10G breakout is supported only on odd numbered ports.
- When an odd numbered port in a quad is broken out, the even ports in that quad are removed and the other odd port in the same quad is broken out automatically to the same speed. For example, if port 1 or port 3 is broken out into 2 x 50, 4 x 25G or 4 x 10G, then the other odd port in that quad is automatically broken out to same speed and ports 2 and 4 in that quad are removed. When the above breakout configuration is removed, all ports in that quad revert to default.
- QSFP28 (100G) transceivers support the 4 x 25G breakout feature. Beginning Cisco NX-OS Release 9.3(5), the 2 x 50G breakout feature is supported.
- QSFP+ (40G) transceivers support the 4 x 10G breakout feature.
- 100G to 2x50G breakout ports
 - Enables the breakout of 100G ports into 2 X 50G ports on all odd ports.
 - Use the interface breakout module 1 port x map 50g-2x command.
- 40G to 4x10G breakout ports
 - Enables the breakout of 40G ports into 4 X 10G ports.
 - Use the interface breakout module 1 port x map 10g-4x command.

Cisco Nexus 9000 C93600CD-GX Switch

Cisco Nexus N9K-C93600CD-GX breakout considerations:

- In Cisco Nexus N9K-C93600CD-GX, every 4 ports from 1 through 24 are referred to as a quad. The breakout configuration and the speed must be same within a quad. The breakout feature may not function as expected if there is a mismatch of speed or breakout configuration within a quad. The six quads are made of ports 1-4, 5-8, 9-12, 13-16, 17-20 and 21-24.
- Beginning Cisco NX-OS Release 9.3(5), 2x50G breakout is supported on ports 1-36.
- 4x25G and 4x10G breakout is supported only on odd ports, between ports 1 through 24. The even ports will be purged within a quad (4 ports).
- When an odd-numbered port in a quad is broken out, the even ports in that quad are removed and the other odd ports within the quad is broken out automatically to the same speed. For example, if port 1 is

broken out into 4x25G or 4x10G, then the other odd port in that quad is automatically broken out to same speed; and ports 2 and 4 in that quad are removed. When this breakout configuration is removed, all ports in that quad reverts to the default configuration.

- 2x50G breakout is supported on all ports from 1 through 24. All ports in a quad are broken out automatically to same speed when one port in a quad is broken out to 2x50G. For example when Port 2 is broken out into 2x50G, ports 1,3, and 4 are automatically broken out into 2x50G.



Note Only RS-FEC is supported on both lanes for 50G speed on ports 1 through 24

- Beginning with Cisco NX-OS Release 9.3(3) ports 25-28 support 4x10G, 4x25G, and 2x50G breakout features. These breakout feature are supported in port pairs. - for example 25-26 and 27-28.



Note Lane 2 of 2x50G should be configured with RS-FEC for link to be up.

- Beginning with Cisco NX-OS Release 9.3(3), consider the following breakout configuration for ports 29-36:
 - QSFP-DD-400G-DR4 transceivers support only the 4 x 100G breakout feature.
 - QSFP-DD-400G-FR4 and QSFP-DD-400G-LR8 transceivers do not support the breakout feature.
 - QSFP28 (100G) transceivers support the 2 x 50G and 4 x 25G breakout features.
 - QSFP+ (40G) transceivers support the 4 x 10G breakout feature.

Cisco Nexus 9000 C9316D-GX Switch

Cisco Nexus N9K-C9316D-GX breakout considerations:

- Port 1-16 breakout consideration:
 - QSFP-DD-400G-DR4 transceivers support only the 4 x 100G and 4x10G breakout feature.
 - QSFP-DD-400G-FR4 and QSFP-DD-400G-LR8 transceivers do not support the breakout feature.
 - QSFP28 (100G) transceivers support the 2 x 50G, 4 x 25G, and 4x10G breakout feature.

Virtual Device Contexts

Cisco NX-OS can segment operating system and hardware resources into virtual device contexts (VDCs) that emulate virtual devices. The Cisco Nexus 9000 Series switch does not support multiple VDCs. All switch resources are managed in the default VDC.

High Availability for Interfaces

Interfaces support stateful and stateless restarts. A stateful restart occurs on a supervisor switchover. After the switchover, Cisco NX-OS applies the runtime configuration.